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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
|-----------------|-------------|----------------------|---------------------|------------------|

10/699,287

10/31/2003

Tony Mule

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05/13/2009

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EXAMINER

DANIELS, MATTHEW J

ART UNIT

PAPER NUMBER

1791

MAIL DATE

DELIVERY MODE

05/13/2009

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

| | | | |
|------------------------------|---------------------------------------|------------------------------------|--|
| Office Action Summary | Application No. 10/699,287 | Applicant(s) MULE ET AL. | |
| | Examiner MATTHEW J. DANIELS | Art Unit 1791 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 January 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 8-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 8-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. **Claims 8, 9, 12, and 13** are rejected under 35 U.S.C. 103(a) as being unpatentable over Choi (US 2002/0094496) in view of Jacobson (US 6,517,995). **As to Claim 8**, Choi teaches method for nano-indentation, comprising:

providing a substrate having a polymer layer disposed on the substrate, the polymer layer includes a polymer material that is in an uncured plastic (liquid) state ([0006]);

providing a stamp mask having a photomask ([0088]) and at least one nano-indentation structure (Fig. 1B, item 14) for forming a physical feature on the polymer layer, wherein the photomask does not cover at least one area of the polymer material (holes, [0088]); and

stamping the polymer material with the stamp mask (Fig. 1B), wherein the polymer material forms the physical feature caused by the at least one nano-indentation structure ([0006]).

Choi is silent to removing the stamp mask and then curing the polymer material after removal.

However, Jacobson teaches that it is possible to remove the stamp mask and then cure (or further cure) the material after the removal (6:19-42).

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It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Jacobson into that of Choi because (a) this is merely the rearrangement of process steps already disclosed by the prior art, which the ordinary artisan generally considers to be obvious (MPEP 2144.04, subsection IV), or (b) the prior art teaches a base device upon which the claimed invention can be viewed as an improvement, ut the prior art teaches a known technique (removal before curing) that is applicable to the similar method of Choi, and one would have recognized that the combination would yield the same result as the Choi process.

As to Claim 9, Choi teaches that the curable material is exposed to light energy ([0006]; [0012]), which would be optical energy, in order to cure the photoresist ([0012]). In the rearrangement set forth above under the rejection of Claim 8 (curing occurs after stamp removal), the combination provides exposing of the material after it is no longer covered by the mask. **As to Claims 12 and 13**, in the Choi process, a polymer structure is formed having the physical feature in the form of a multi-tooth feature (Fig. 2D).

2. **Claims 10 and 11** are rejected under 35 U.S.C. 103(a) as being unpatentable over Choi (US 2002/0094496) in view of Jacobson (US 6,517,995), and further in view of Schwartzkopf (US 4,959,293). Choi and Jacobson teach the subject matter of Claim 8 above under 35 USC 103(a). **As to Claim 10**, Choi is silent to the removing the exposed area. However, the ordinary artisan understands positive and negative photoresists to be interchangeable. See, for example, the Schwartzkopf abstract. In fact, UV photoresists such as that of Schwartzkopf can be either positive or negative depending on the resist composition used. Combining Schwartzkopf with

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Choi suggests that either the exposed or unexposed areas could be removed. It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Schwartzkopf into that of Choi because (a) Choi suggests a photoresist composition, and Schwartzkopf provides a photoresist composition, or (b) one would have been motivated to use the Schwartzkopf photoresist in order to provide greater semiconductor fabrication capability.

3. **Claim 11** is rejected under 35 U.S.C. 103(a) as being unpatentable over Choi (US 2002/0094496) in view of Schneider (US 3,936,301). Choi teaches the subject matter of Claim 8 above under 35 USC 102(b). **As to Claim 11**, Choi teaches curing by application of UV light, but is silent to the removal of the polymer material not exposed to the optical energy. However, Schneider teaches to expose portions of a photoresist through a contact mask and to remove the portions not exposed to the optical energy (4:1-8). It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Schneider into that of Choi because Choi suggests use of a mask which contacts a photoresist and exposure of the resist, and Schneider provides a process specifically suggested for masks which contact a photoresist surface.

4. **Claims 14, 15, 17, 18, 20, and 21** are rejected under 35 U.S.C. 103(a) as being unpatentable over Choi (US 2002/0094496) in view of Jacobson (US 6,517,995) and Canavello (US 4,379,833). **As to Claim 14**, Choi teaches a method of forming a structure, comprising:

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providing a substrate and a polymer layer (Fig. 2B, items 18, 20, 40), the polymer layer is disposed on the substrate (Figs. 2A-2C), wherein the polymer layer includes a negative resist (Fig. 2C, 2D), wherein the polymer material is in an uncured plastic state (Fig. 2C, 2D).

providing a stamp mask having a photomask ([0088]) and at least one nano-indentation structure for forming a physical feature on the polymer layer (Fig. 2D, item 12), wherein the photomask does not cover at least one directly exposed portion of the polymer material (holes, [0088]);

stamping the polymer material with the stamp mask, wherein the polymer material forms the physical feature caused by the at least one nano-indentation structure (Fig. 2A-2D); and

exposing the at least one directly exposed portion of the polymer material to optical energy, wherein the optical energy passes through the at least one directly exposed portion of the polymer material (Fig. 2C, item 32).

Choi is silent to (a) the at least one element on the surface selected from a refractive and diffractive element and using the refractive element to form an indirectly exposed region, and (b) curing the polymer material after the stamp mask is removed.

However, Canavello teaches (a) that it is known to provide an element (22) selected from a refractive element (mirror) wherein the light from an exposure process is reflected off the element (26) forming an indirectly exposed portion of polymer material (26). It is submitted that the reflective elements of Canavello would also inherently scatter light in oblique directions, thus providing additional exposed portions outside the mirror elements.

Additionally, Jacobson teaches that it is possible to remove the stamp mask and then cure (or further cure) the material after the removal (6:19-42).

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It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Jacobson into that of Choi because (a) this is merely the rearrangement of process steps already disclosed by the prior art, which the ordinary artisan generally considers to be obvious (MPEP 2144.04, subsection IV), or (b) the prior art teaches a base device upon which the claimed invention can be viewed as an improvement, ut the prior art teaches a known technique (removal before curing) that is applicable to the similar method of Choi, and one would have recognized that the combination would yield the same result as the Choi process.

It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Canavello into that of Choi because (a) the reflective mirror elements of Canavello would have provided a desirable improvement in efficiency to the Choi process, or (b) one would have found it desirable to adjust or regulate the application of light to the photoresist in Choi, and use of reflective elements would have been a conventional means for accomplishing this result. **As to Claims 15 and 18** Canavello suggests positive or negative resists (Abstract), and the material is either removed or preserved depending on the type of resist (3:27-34). **As to Claim 17**, in view of Canavello's suggestion to use reflected light for exposure, it is submitted that one of ordinary skill in the art would have found it obvious to use reflective elements to reflect light within the photoresist in other directions, and to thereby create slanted walls. **As to Claims 20 and 21**, in the Choi process, a polymer structure is formed having the physical feature in the form of a multi-tooth feature (Fig. 2D), which would inherently be usable as a waveguide.

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5. **Claim 17** is rejected under 35 U.S.C. 103(a) as being unpatentable over Choi (US 2002/0094496) in view of Canavello (US 4,379,833), and further in view of Otsuka (US 5,643,700). **As to Claim 17**, Choi and Canavello do not expressly teach the slanted polymer material. However, Canavello does teach reflective materials on the substrate. Additionally, Otsuka teaches oblique application of radiation to a photoresist surface (2) and reflection off a substrate (1a). In view of Canavello's suggestion to use the substrate as a reflective element, and Otsuka's teaching that this (a reflective surface) may be further combined with oblique application of light, it is submitted that one would have found it obvious to reflect radiation in oblique directions. It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Otsuka into the modified method of Choi because the oblique application of radiation into a photoresist is conventional for use with reflective substrates, as disclosed by Otsuka, and the combination would have merely provided the expected result of a slanted configuration in the photoresist similar to that achieved with grayscale masks.

6. **Claims 16, 17, and 19** are rejected under 35 U.S.C. 103(a) as being unpatentable over Choi (US 2002/0094496) in view of Canavello (US 4,379,833), and further in view of Gal (US 5,480,764). Choi and Canavello teach the subject matter of Claim 14 above under 35 USC 103(a). **As to Claims 16, 17, and 19**, Canavello suggests positive or negative resists (Abstract), but Choi and Canavello are silent to the formation of a slanted polymer wall or a tunnel. However, Gal teaches that it is known to form slanted polymer layer walls by exposing and developing photoresist to form an angle designed for use in a tunnel (Figs. 15-27). Subsequent

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use of this reflective element in forming tunnels would have been obvious in view of Gal's teaching in Fig. 22, which demonstrates. It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Gal into the modified process of Choi because Choi teaches a process for exposing photoresist, and Gal teaches that photoresist and reflective elements can be used to form tunnels useful as waveguides. Thus, Choi suggests a technique for fabricating photoresist, and Gal teaches a technique in which a particular article is formed from photoresist.

Response to Arguments

7. Applicant's arguments filed 30 January 2009 have been fully considered but they are not persuasive or are moot in view of the new grounds of rejection above. The arguments appear to be on the following grounds:

- a) With respect to Claims 9 and 14, there is no teaching of the new limitation of removing the stamp mask and curing the polymer material after the stamp mask is removed. Choi teaches that the polymer material, a liquid is cured while the template is disposed on the polymer material so that the polymer material can harden and assume the shape of the space defined by the gap. If removed prior to curing, it would not form the shape of the space defined by the gap. The polymer of Choi is not in a "plastic" state.
- b) Choi teaches curing the polymer material exposed to optical energy, while Claim 10 recites curing the material not exposed to the optical energy, and removing the at least one exposed area of the polymer material.

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8. These arguments are not persuasive for the following reasons:

a) With respect to the argument that there is no teaching of curing after removal of the stamp mask, it is submitted that the rearrangement of steps asserted to be lacking from Choi is known in the prior art. See Jacobson, column 6. With respect to the argument that Choi does not provide a "plastic" state, clarification may be necessary. A text search was performed within the published application (US 2005/0257709) and every instance of the word "plastic" has been examined to interpret the term. There does not appear to be any definition provided for the term in either the application or in the arguments, and the context is insufficient to provide any precise meaning to the term.. The Examiner submits a portion of Hawley's Condensed Chemical Dictionary which defines plastic as "capable of being shaped or molded with or without the application of heat." It is respectfully submitted that Choi (and/or Jacobson) provide materials which meet this definition. If "plastic" is meant to have some other definition in this application, it has not been set forth in the application.

b) Resolving the level of ordinary skill in the art through the Graham factors, it is submitted that the ordinary artisan understands positive and negative photoresists to be interchangeable. See, for example, Canavello (abstract). Additionally, Schwartzkopf teaches that even the same photoresist can be used as a positive or negative photoresist depending on the developer used. Since positive and negative photoresists are recognized in the art to be interchangeable, it is submitted that one practicing the Choi process would have also viewed them as interchangeable in that process.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW J. DANIELS whose telephone number is (571)272-2450. The examiner can normally be reached on Monday - Friday, 8:00 am - 4:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Christina Johnson can be reached on (571) 272-1176. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Matthew J. Daniels/
Primary Examiner, Art Unit 1791
5/11/09